



Influence of rapid glacial Tongue Retreat on a surface Area of the glacial Lakes in the Cordillera Blanca, Peru

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Research in the high mountain areas of is bringing ongoing evidence for large and rather quick deglaciation of the mountain ridges. Diminishing of mountain glaciers has strong influence on hydrologic and hydro-geologic conditions of the affected regions and largely controls respective geomorphic process. Presented poster evaluates changes in the glacial lakes surface areas and stability conditions of their banks since they substantially influence evolution of dangerous glacial lake outburst floods (GLOFs) in the Cordillera Blanca, Peru.

At least 19 glacial lake outburst floods occurred in the Cordillera Blanca Mountains over past 250 years (Zapata 2002). The single catastrophic event of large GLOF from the Palcacocha Lake in 1941 killed about 4,300 people in the city of Huarás. Richardson and Reynolds (2000) estimate some 32,000 victims of glacial lake outbursts in the whole Peru during the 20th century.

The evaluation of surface extend of glacial lakes in the central part of the Cordillera Blanca Mountains (between River Negro on the east and River Santa Cruz on the west) was done by comparing 1984 SPOT with 1999 LANDSAT satellite images. All together, seven lakes with noticeable increase of the water surface area were identified. Six of these lakes are dammed by moraines and at least three of them have produced GLOFs in the past. This shows importance of permanent monitoring of natural hazards connected with glacial lakes which is further stressed by the fact that two of the identified lakes are drained through the local capital city of Huarás.

Relative indicator of a lake surface area increment identified from 1984 and 1999 satellite images was calculated as percentage of the original lake surface area iden-

tified from 1984 satellite image. Results show that the glacial lakes can expand their surface area by more than 350% of their initial area within 15 years. Nonetheless well-documented case of the Palcacocha Lake shows that the glacial lake may increase by 70 m in length within one year! Such rapid retreat of the glacial tongue causes decrease of the stability of the moraine lake banks and subsequently planar landslides occurrence.

Despite of the rapid retreat of the glacial tongue the GLOF hazard of the Palcacocha Lake is still low compare to its conditions before 1941 flood. Before that event the estimated volume of the lake was from 9'000,000 to 11'000,000 m³ which dropped after the breach to measured volume of 514,800 m³ in 1972 (Ojeda, 1974). Ongoing deglaciation has again raised the volume of the Palcacocha Lake up to 3'959,776 m³ in the 2003 (Zapata et al., 2004).

The works prove that the hazard of producing new GLOFs in the central part of the Cordillera Blanca Mountains have been remarkably lowered by previous floods. On other hand, it shows rather rapid increment of stored water volume in the moraine dam lakes, which produces favorable conditions for GLOF evolution. This fact along with increasing vulnerability of potentially affected urban areas stress the importance of monitoring of the lakes dam stability conditions and the effects of the rapid deglaciation.

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